

RECOGNITION OF NEST, EGGS, NEST SITE, AND YOUNG IN FEMALE RED-WINGED BLACKBIRDS

FRANK W. PEEK, EDWIN FRANKS, AND DENNIS CASE

IN general, birds which build nests recognize and respond to their nest sites and later their young but show little evidence of being able to specifically recognize their nests or eggs (see Nice, 1943; Tinbergen, 1953; Davies and Carrick, 1962; and Beer, 1970). In species which do not build nests, such as the Common Murre (*Uria aalge*), both the egg and the laying site are specifically recognized and responded to (Johnson, 1941). In the Tricolored Blackbird (*Agelaius tricolor*), which nests in dense colonies, the adults feed any young Tricolor placed in their nests and thus do not specifically recognize their own young (Emlen, 1941, and Lack and Emlen, 1939). In species in which parents recognize their own young the speed with which recognition develops appears to be faster the shorter the time the young spend in the nest (Davies and Carrick, 1962). The majority of the studies cited above and others in the literature were done with non-passerines and investigated only one or two factors of the nesting situation at only one period of the breeding cycle. The present study examines in a passerine, the Red-winged Blackbird (*Agelaius phoeniceus*), the responses of the female Redwing to the nest site, nest, eggs, and young throughout the entire nesting cycle.

METHODS

Experiments were carried out during May and June, 1968 and 1969 on a small (16.5 acre) fresh-water marsh near State College, Pennsylvania. The marsh contained 27 Redwing nests in 1968 and 12 in 1969. Observations were made with the aid of 7×50 binoculars and a $25\times$ spotting scope from concealed locations at considerable distances from the nests. The data on nestling vocalizations were obtained from two Redwings taken from different nests in a marsh near St. Paul, Minnesota in July, 1970. Vocalizations were recorded on magnetic tape at $7\frac{1}{2}$ ips using a Uher 4000 Report-L recorder and a Uher omnidirectional microphone.

RESULTS

Response to the nest.—Six experiments were conducted in which a female's entire nest along with its supporting vegetation was dug up and replaced with another Redwing nest from the same marsh. All nest substitutions were made while the female was off the marsh, and thus out of sight of her nest. All the original nests were constructed entirely of sedge (*Carex* sp.) and were situated on the tops of sedge tussocks. In the first three experiments the substitute nests closely resembled the originals in that they were also constructed of sedge and were situated on sedge tussocks. Each of the females upon returning to

the substitute nest settled upon it without hesitation. In the fourth experiment the female also settled without hesitation upon a substitute nest which, though built on a sedge tussock, was largely constructed of cattail (*Typha* sp.). In the fifth and sixth experiments the substitute nests differed strikingly from the originals in that they were constructed entirely of cattail and were supported by cattails rather than sedge tussocks. Upon returning to these nests the females were at first quite distressed; however, both accepted the strange nests within 15 minutes. Holcomb (1971) has demonstrated that female Redwings tolerate considerable alteration of their nests without abandoning them. These observations are also consistent with those reported for other species. For example, Lashley (1915) found that Sooty Terns (*Sterna fuscata*) responded positively to any nest at the chosen site.

Response to eggs.—In these experiments the entire clutch of a female was replaced with eggs from another nest. Egg substitutions involved interchanging clutches containing the same number of eggs as well as clutches with different numbers of eggs and also with young. Birds readily accepted substitute clutches of eggs even though they invariably differed slightly in color and pattern from the original clutch. They also accepted both increases and decreases in clutch size (three eggs substituted for four, two for four, four for three, and four for two). These findings agree with those of Holcomb (1971) who found that female Redwings readily accepted artificial eggs similar to their own and tolerated both increases and decreases in clutch size. Females of the closely related Tricolored Blackbird also accepted eggs of other Tricolors and tolerated alterations in clutch size (Emlen, 1941). Under the criteria of these experiments the female Redwing does not discriminate between her own eggs and those of other Redwings or similar artificial eggs. She does, however, discriminate against eggs of the Brown-headed Cowbird (*Molothrus ater*). During the course of the present study, two Cowbird eggs were found covered over with nesting material. Friedmann (1963) also reported instances of Redwings building over Cowbird eggs.

Female Redwings clearly were aware of change when eggs were substituted for a mixture of day-old young and eggs, and vice versa; however, little else can be said on the basis of one observation of each manipulation.

As already mentioned, the ability to recognize eggs varies with the ecology of the species. Johnson (1941) interchanged the eggs of three Common Murres nesting near each other. When the birds returned, each went to its own egg and rolled it back to the original site. Murres lay their eggs on bare rock cliffs where they are likely to roll; hence individual recognition of eggs has adaptive significance.

Response to the nest site.—In one set of experiments five nests containing eggs were moved various distances (2, 3, 5, 7, and 10m) while the females

were away. Each nest was moved only once and all movements were within the original territory. In all cases females returned to the original nest site before locating their displaced nests. On as many as 15 subsequent trips females returned to the original nest site before flying to the relocated nest. The nest displaced a distance of 10 m was abandoned.

These results show that female Redwings have an attachment to the site and return by "habit" to their own nest sites even when the nests have been removed. This is undoubtedly important in their willingness to accept even very dissimilar nests placed on the original nest site as discussed above. The cues which the bird uses to locate its nest site were not investigated.

These results agree with an experiment reported by Nero and Emlen (1951) in which a Redwing nest and eggs were moved for a second time a distance of 3 m while the female was absent. Upon returning she went first to the site where the nest had last been located and then to the site from which it has been moved the previous day. She finally located the nest on its new site and accepted it. Nero and Emlen also report a number of other experiments in which Redwing nests containing eggs and/or young were moved 1.5 or 2 m while the female watched. In these cases the females returned directly to their nests rather than to the former sites. In these experiments females even followed nests which were moved across territorial boundaries. In experiments with the Sooty Tern (Lashley, 1915) and House Sparrow (*Passer domesticus*) (Nice, 1943), however, birds returned to former nest sites rather than to nests displaced short distances.

A second set of experiments was done with two females whose nests, each containing three eggs, were built in sedge tussocks. While each female was away, her nest and eggs were moved to a position 4 m from the original nest site (within the same territory) and replaced with another nest (Cattail in both cases) also containing three eggs. The results were essentially the same for each bird. When the female returned to her nest site, she settled on the new nest, got off and returned by the same route several times during the next 3 hours. One bird also flew over to her own nest at the new site but finally settled on the new nest at the old site and remained there for a normal incubation bout (30 min average duration). The original nest and eggs were then moved back to within 0.5 m of the new nest. The female continued to return to the new nest on the original site for 2 hours despite the presence of her own nest and eggs 0.5 m away. The new nest and original nest were then interchanged; the original nest was now back on the original site. The female returned without hesitation to the original nest and site. The two nests were again interchanged after the female left and the female continued to return to the original nest site, now containing the new nest and eggs, for the rest of the afternoon. On the following day, both females were returning to

TABLE 1
RESPONSE OF FEMALE TO SUBSTITUTE NESTLINGS AND DISPLACEMENT OF OWN NESTLINGS

Female	Age of Nestlings Removed and Placed in a Nearby Nest (days)	Age of Substitute Nestlings (days)	Response of Female
1	1	2	settled on nest with no hesitation
2	2	1	"
3	2	3	"
4	3	2	"
5	3	4	"
6	4	3	"
7	6	7	"
8	7	6	accepted but showed distress
3	10	11	followed young to new nest
4	11	10	"
5	10	11	"
6	11	10	"
9	10	none substituted	"
10	11	"	"

their original nests, which were 0.5 m from the original sites. The replacement nests and eggs were still at the original sites. Both females eventually fledged young from their original nests.

These results show that the female is more strongly attached to her nest site than to her nest and eggs, but that she discriminates against a substitute nest and eggs if her own are not far removed from the original site.

Response to young.—The female Redwing's response to her young was investigated by replacing a female's own young with an equal number of nestlings from another nest (in two cases a female's young were moved and no replacement was made). The substituted nestlings were within a day of being the same age as the female's own young. In all cases the female's own young were placed in a nest 3 to 6 m away within the same territory. The reaction of the female depended upon the age of the nestlings at the time the manipulation was made (Table 1). If the female's own young were less than 7 days old, the female settled upon the nest with no hesitation. The female whose nestlings were 7 days old apparently had developed some degree of recognition of her own young and was disturbed by the interchange. By the time the

young were 10 days old, the female specifically recognized her own young and followed them to their new location.

Females 5 and 6 (Table 1) were both nesting in the same male's territory, 6 m apart. Over a period of 14 days their nests, then their eggs, and then their young (at two ages) were interchanged. In agreement with results discussed above, interchanging nests and eggs had no measurable effect upon the females; both females readily returned to their original nest sites which contained either a different nest or different eggs. The first time the nestlings were interchanged at ages 3 and 4 days, both females readily accepted the foster nestlings. When the nestlings were again interchanged at ages 10 and 11 days, the females immediately switched nest sites, remaining with the nestlings they had cared for during the previous 7 days (these nestlings were not the young they had hatched and initially brooded for 3 and 4 days, respectively). The females thereafter stayed with the young they had followed to the alien nest site until they fledged 1 or 2 days later. The females had, during a 7-day period, formed a specific attachment to the 3 and 4 day-old foster nestlings. Females 3 and 4 (Table 1) were also nesting within one male's territory (4 m apart). Their young were successfully interchanged at 2 and 3 days of age. When the young were again interchanged at 10 and 11 days of age, the females switched nest sites, as did females 5 and 6, and remained with their young until they fledged.

These results agree with those discussed by Davies and Carrick (1962) for a number of gull species. The gulls learned to recognize their own young before the young left the nest. Nice's (1937) Song Sparrows (*Melospiza melodia*) behaved similarly. She found that parents did not recognize their own young under 7 days of age. Alley and Boyd (1950) found that parent European Coots (*Fulica atra*) gradually learned to recognize their own young over a period of 2 weeks after the young were able to swim and leave the nest. The following species have been shown not to recognize their chicks, at least in the nest: Kittiwake (*Rissa tridactyla*) (Cullen, 1957); Tricolored Blackbird (Emlen, 1941); and Black Phoebe (*Sayornis nigricans*) (Kinsey, 1935).

Beer (1970) has pointed out that experiments in which young are interchanged provide inconclusive evidence that parental recognition has occurred. The possibility exists in such experiments that the young might discriminate among adults or might react to being placed in a strange nest, with the result that their behavior (rather than any individual characteristics) marked them as foreign and caused the strange adults to reject them. However, specific recognition of young is demonstrated in the present study when females followed their own young to different nest sites.

The behavior of females which followed their young to new nest sites strongly suggested that they used the vocalizations of the young to find them.

After an interchange of young had been made, the females first hovered over their own nests for a short time, then flew directly to the nest which contained their own young, and eventually settled on it. Since the nests were situated deep in sedge tussocks, the young were concealed except from directly overhead, making it impossible for the female to see them until she was directly over the nest.

Observations were also made on two captive Redwings taken from different nests at age 10 days. In agreement with Nice (1950), these birds gave loud location notes at approximately hourly intervals, and ceased calling when fed. Tape recordings of their calls were made during their tenth and eleventh days of age. Sonagrams show that the character of the calls varied little within an individual but were distinctly different between individuals. The location call presumably enables the parent to recognize and find its young even though the latter are motionless and hidden in tall vegetation. The call may also stimulate the parent bird to feed the young.

CONCLUSION

Tinbergen (1953) introduced the terms "specific recognition" and "non-specific recognition" when referring to responses of parent birds to factors in the nesting situation. Nonspecific recognition refers to those factors which are innately recognized as belonging to the species. For example, a wide range of Red-winged Blackbird eggs would be recognized nonspecifically by a female Redwing and therefore would be appropriate for incubation. Thus, a moderate range of eggs can satisfy her. Markedly differing eggs, such as those of cowbirds, are not accepted.

In the present study, female Redwings were found to recognize the nest, eggs, and young under 7 days of age nonspecifically. Replacements of any of these by counterparts from another Redwing nesting situation were quickly accepted.

Specific recognition of factors in the nesting situation must be learned. At least one factor or aspect of the nesting situation must be specifically recognized or parent birds would stop at the first conspecific nest encountered rather than returning to their own nests. Female Redwings were found to recognize specifically the nest site and young older than 7 days. Females returned to their specific nest sites, and after the young were about 7 days old, learned to recognize them or their calls specifically. At this time the female becomes more strongly attracted to the young than to the nest site, for she will abandon the site to follow the young. Since the female Redwing feeds her young after they fledge, this transfer of attachment must occur prior to the time the young leave the nest. The present study shows that this happens when the young are about a week old.

SUMMARY

Responses of female Red-winged Blackbirds to substitute nests, eggs and young, and to displacements of nests and young were investigated. Females show a strong attachment to nest sites throughout the nesting period. They preferred to remain at the nest site even though the nest, eggs, and young (under 7 days old) were replaced with counterparts from other Redwing nest situations. When young older than 10 days were displaced from the nest site, females abandoned the site and followed the young. Female Redwings therefore learn to recognize their young during the period they are in the nest. The earliest females were found to show signs of recognizing their young was 7 days post-hatching. This recognition is probably partly based upon the location call which is given only by older young. Though the structure of the location call remained the same from one utterance to the next for an individual, it differed markedly between individuals.

LITERATURE CITED

- ALLEY, R., AND H. BOYD. 1950. Parent-young recognition in the Coot *Fulica atra*. *Ibis*, 92:46-51.
- BEER, C. G. 1970. Individual recognition of voice in the social behavior of birds. In Lehrman, D. S., R. A. Hinde, and E. Shaw, eds., *Advances in the study of behavior*, 3:27-74. Academic Press, New York.
- CULLEN, E. 1957. Adaptations in the Kittiwake to cliff-nesting. *Ibis*, 99:275-302.
- DAVIES, S. J. J. F., AND F. CARRICK. 1962. On the ability of Crested Terns, *Sterna bergii*, to recognize their own chicks. *Australian J. Zool.*, 10:171-177.
- EMLEN, J. T., JR. 1941. An experimental analysis of the breeding cycle of the Tricolored Redwing. *Condor*, 43:209-219.
- FRIEDMANN, H. 1963. Host relations of the parasitic cowbirds. U. S. Natl. Mus. Bull., No. 233.
- HOLCOMB, L. C. 1971. Nest building and egg laying by Redwinged Blackbirds in response to artificial manipulations. *Auk*, 88:30-34.
- JOHNSON, R. A. 1941. Nesting behavior of the Atlantic Murre. *Auk*, 58:153-163.
- KINSEY, E. C. 1935. Parental instincts in Black Phoebes. *Condor*, 37:277-278.
- LACK, D., AND J. T. EMLEN, JR. 1939. Observations on breeding behavior in Tricolored Red-wings. *Condor*, 41:225-230.
- LASHLEY, K. S. 1915. Notes on the nesting activities of the Noddy and Sooty Terns. *Carnegie Inst. Wash.*, 211:61-83.
- NERO, R. W., AND J. T. EMLEN, JR. 1951. An experimental study of territorial behavior in breeding Red-winged Blackbirds. *Condor*, 53:105-116.
- NICE, M. M. 1937. Studies in the life history of the Song Sparrow. I. A population study of the Song Sparrow. *Trans. Linnaean Soc. N. Y.*, 4:1-247.
- NICE, M. M. 1943. Studies in the life history of the Song Sparrow. II. The behavior of the Song Sparrow and other passerines. *Trans. Linnaean. Soc. N. Y.*, 6:1-328.
- NICE, M. M. 1950. Development of a Redwing (*Agelaius phoeniceus*). *Wilson Bull.*, 62:87-93.
- TINBERGEN, N. 1953. *The Herring Gull's world*. Collins, London.

DEPARTMENT OF ANIMAL SCIENCE, UNIVERSITY OF MINNESOTA, ST. PAUL, MINNESOTA 55101, DEPARTMENT OF BIOLOGICAL SCIENCES, WESTERN ILLINOIS UNIVERSITY, MACOMB, ILLINOIS 61455, AND OFFICE WATER QUALITY PROGRAM, 3090 BROADWAY AVENUE, CLEVELAND, OHIO 44115, 15 OCTOBER 1971.